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CRITTENDEN

The County's Natural Resources.

A BRIEF STATEMENT OF THE TOPOGRAPHY, DRAINAGE, AND AGRICULTURAL POSSIBILITIES.

Lead, Zinc and Spar Deposits; Mineral Paint Beds, Etc.

A Plain Statement of Facts from Prof. Ulrich.

Editor Crittenden Press.

In reply to your letter of a few days ago, requesting a brief account of the natural resources of the county, permit me to say (1) that any thing I can do toward the development of her latent wealth will be done with pleasure; and (2) since such a general interest and desire for knowledge regarding the mineral deposits of Crittenden have been called to life, I believe that I cannot better occupy my already fully occupied time than by writing the following conservative statement:

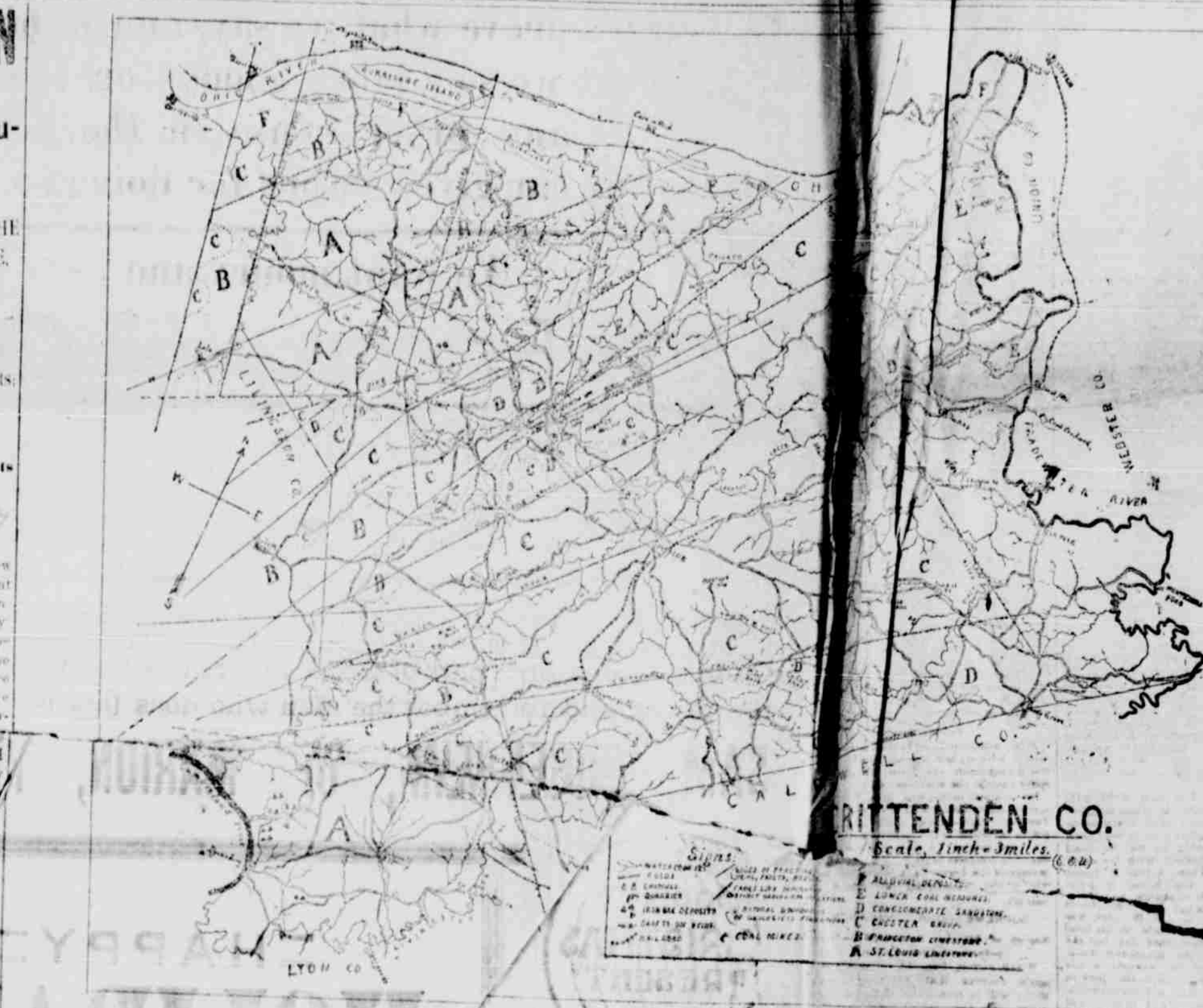
As you will probably wish to publish my letter, it may be well to say why I may be expected to know something of the county.

In the fall of 1888, Prof. John R. Procter, the accomplished Chief of the Geological Survey of the State, sent me to Western Kentucky to make a careful and systematic survey of the two counties of Caldwell and Crittenden. A good part of the two years passed since that date were spent in field-work there, and though the region presented unusual geological difficulties, it may be claimed, without much fear of contradiction, that no portion of the State has received a more thorough investigation. My report is now ready for publication, and will be placed into the hands of the State printer as soon as he is through with the work for the Constitutional Convention, which at present is claiming his entire attention. This unexpected delay in the publication of the full report, makes it desirable that at least a digest of its contents be published in advance. Indeed, the numerous inquiries which have been made during the last two months, make such a publication not only desirable but necessary, if I would not put more time on individual answers than I can spare. I have, therefore, concluded to write you a fairly full and perfectly unprejudiced and conservative account of the results of my work in Crittenden. To make these more available, I have prepared the accompanying map, drawn to the scale of one inch—three miles, and showing, I believe in as clear a manner as possible on so small a scale, the outlines of the county, the watercourses, roads, the location of the towns, post offices, principal churches and other well known points besides, the outlines of the different geological formations, the courses of the veins and fractures of the strata and location of mineral deposits of various kinds. It may take some time to decipher all these features, but if you will print it properly, I have no doubt that most everyone will succeed in doing so.

TOPOGRAPHY AND DRAINAGE.

The topography of the county, taken as a whole, is decidedly hilly. Much of this unevenness is the result of an unusually extensive system of fracturing which this portion of Kentucky has been subjected to. Many interesting problems are connected with these convulsive movements of the earth's crust, which so frequently result in marked topographical peculiarities, and in this region generally affect, if they are not the controlling factors of the lines of drainage. These movements have further been of consequence to Crittenden in this that to them she owes her metalliferous veins. Denudation and the leveling influences of time have wrought great changes since the shake up era. Indeed, cases might be pointed out where the present topography is quite the opposite of what it must have been immediately after that era; but, as the object of this communication is to show what is rather than what has been, their discussion would be out of place here.

Except in the southern and north-



western portions of the county, the hills consist almost uniformly of sandstones. In the exceptional regions of the "flat" or "short" lands of the St. Louis limestone is the predominant rock. It is to the "flat hills" of these regions that the valuable limonite iron ores are restricted. Drainage is ample as may be seen from the abundance of the streams. Most of these flow into the Ohio river, which forms the northern boundary of the county. The Trade-water flows along the northeastern border and the Cumberland forms about one-fifth of the southwestern boundary. The possession of facilities for cheap transportation, such as is afforded by these navigable rivers, is the first importance in the development of the resources of any locality. Their value here cannot be overestimated.

GEOLOGICAL FORMATIONS, SOILS AND MINES.

The geologically lowest or oldest formation of the surface in the county is the St. Louis limestone of the sub-carboniferous system. The limestone itself is but rarely seen, and only at such points where the change is deep. It outcrops along the Cumberland river in the vicinity of Dycusburg, and in the bed of Cane Fork at Tola. The limestone is compact, siliceous, and of various shades of blue. The beds at Dycusburg are fine grained magnesian limestone, and would no doubt make good hydraulic cement.

The regions of the county that are underlain by this group of limestones (marked A on the map) are distinguished by an abundance of chert or flint blocks, which have remained as a residue after the disintegration of the limestone. The soil covering this chert debris is rarely deep, but very productive. Timber grows well and rapidly on it, and when sufficient care is exercised to prevent its washing, it maintains its rank as one of the best soils of the State for a long time.

Resting on these cherty limestones is the thicker series of limestones to which I have applied the name of Princeton group. They have a thickness in the county of about 200 feet, and the spaces where they are at the surface are marked "B" on the map. The lower 150 feet consists mainly of white oolitic limestone, many of which would afford good building stone, while the most of the beds could be burned into lime of superior quality. This portion of the group also furnishes the best soils of the county. These are practically inexhaustible, and in fertility are scarcely inferior to the famous "blue grass" soils of central Kentucky.

The regions where the Princeton limestones are the surface rock are not very extensive, yet they constitute a fair proportion of the area of the county. Four of these regions deserve mention: The first and

smallest is in the north eastern corner of the county; the second forms a triangular area in the east of Tola, and both are marked on the north by broad strips of bottom lands; the third is the Princeton valley, while the fourth is the northeast extension of the well known Salem valley, and extends into this county, from Livingston, as far as Lewis. The formation next above the last is known to geologists as the Chester group. It consists in this county mainly of sandstones, the limestones and soft shales which are the predominant constituents of the formation in other sections of the county, being but little developed and in part totally absent here.

Over about two-fifths of the area of the county, as may be seen by noting the distribution of the spaces marked "C" on the map, the Chester group of rocks are at the surface, and the total thickness of the strata referred to the formation is not less than 400 feet. Most of this large area is more or less hilly and supports a fine body of timber, with oaks predominating. Considerable tracts, however, are approximately level and well suited for farming purposes. The conglomerate sandstone which is the lowest formation of the coal measures, rests on the Chester. This sandstone is coarse and generally contains small pebbles of white quartz. The region where it prevails (marked "D" on map) are almost invariably high ground. Pilot, Cedar, Hardin's and other knobs, and the high hill, on the west side of the Crittenden Springs valley are formed of this massive rock. The soil, as usual with conglomerate soils, is but ill adapted for primary agricultural purposes, but the timber on the contrary, are not surpassed either in quality or quantity, by those of any other formation of the State. These high knobs are also, without doubt, eminently suited for fruit culture.

Indeed, Crittenden county has natural advantages that respect that are perhaps equal to any in the country. It is a feature that deserves to be remembered in the future development of the county. In the regions marked "E" the lower coal measures are at the surface. These are mainly of importance because of the excellent beds of coal which they contain. They will be discussed in a succeeding section. The soil is generally above the average, while the timber growth is nearly as luxuriant and good as that of the conglomerate described in the preceding paragraph.

The spaces marked "F" represent beds of very soft green and purplish shales occurring on a level with the O. V. R. R., beneath the limestones of Giles quarry, about one and a half miles west of Nunn station. The other is from an even thicker bed of shales on land belonging to Mr. Wm. Wilson, situated about midway between Marion and Crittenden.

Building stone, lime, clay, etc. Building stone of good quality and varieties occurs abundantly throughout the county. The Princeton limestone, especially in the Clements valley near Bepko church, could be made to furnish unlimited quantities of oolitic limestone, nearly all of which could be burned into lime of extra quality. Some of the beds would furnish also large blocks of this stone, which is so deservedly esteemed as a building rock. The hydraulic limestone on the Cumberland at Dycusburg and other points along the river has been mentioned already. As needs can be determined from analysis, this rock should make a good quality of hydraulic cement.

Sandstone suitable for ordinary building purposes is present in plenty. Flagging of unusual hardness and remarkably even surface is found in great quantity in the hills east of Crayneville. Massive beds of light colored sandstone also occur there. Many of these sandstones are almost pure quartz and have been used with success as furnace linings. Many points in the county might be mentioned where good building stone both of lime and sandstones, might be quarried, but lack of space forbids.

Brick clays of good quality are abundant in the regions where the Princeton limestone is at the surface. One bed in particular deserves mention. This is exposed in the roadside a short distance north of New Salem church. Its natural light red color changes to a brownish red when the clay is burned. Brick manufactured from this clay would have a more desirable color than any other known to me from Western Kentucky. Common red pottery ware could also be made of it, and it would prove very well as a cheap pigment.

A large bed of timber and yellow cohes, of very fine quality, occurs on the land of Mr. ——— Murphy, situated about five and one-half miles southwest of Marion. With better facilities of transportation this deposit cannot fail to remunerate investment. The bed is between six and eight feet thick, and has been traced over an area of at least eight acres.

Other cheap pigments could be manufactured from the soft chester shales which are exposed at several points in the county. I will mention only two beds which have been sampled and tested with satisfactory results. The first is an eight foot bed of very soft green and purplish shales occurring on a level with the O. V. R. R., beneath the limestones of Giles quarry, about one and a half miles west of Nunn station. The other is from an even thicker bed of shales on land belonging to Mr. Wm. Wilson, situated about midway between Marion and Crittenden.

COAL.

Only one bed of coal having a commercial value occurs in the county. This bed is however of such excellent quality that its importance as a factor in the development of the county is scarcely to be overestimated. Its general excellence as a fuel coal had long ago been recognized. Before the decadence of the steam at traffic, the Trade-water coals, as they were called, were esteemed above all others by river men for steam making qualities. Before the war the Bell's, Casey's and other mines were worked vigorously. Even now when the principle demand for the output of these mines has practically ceased, limited operation are maintained at some of them. This is possible only because of the premium they command over competing coals, otherwise it would not pay the miners to haul their product sixteen miles to Marion over distressingly rough roads.

But the principle value and feature of this coal lies in its coking qualities, and in this it fills a want that is becoming more strongly felt every year. As will be seen later on, the coke made from the Trade-water coals, seems to compare favorably in every essential feature with the best coals of the country. And the value of this fact in the development of the county's iron and other mineral deposits cannot be overestimated.

This coal seam is one of the lowest in the series of true coals. It outcrops at a number of points along the Trade-water from the mouth of that stream to Blackford, where the line of outcrop crosses over into Webster. Only two mines are in operation in the county, Barnby's ("Kid and Jack") and Tate's, but evidences of former activity are to be seen at Lamb, Cassey, Bells, Sparks, Miners shaft, Cooke and Nunn or Sneeds mines. Across the river in Webster, the Crab Orchard creek mines, which I regard as the same bed, are fairly active.

The average thickness of the seam as noted at all these points is about four feet, with the extremes of variation three feet six inches and five feet. The roof, wherever I have seen it, is excellent, consisting generally of shaly sandstones. At limited points in the mines there may be a few inches of black shale, or shales, or of softer gray shales between these and the coal. At the top of the coal there is almost invariably a thin layer (several inches) of coal that is usually termed a cannel, by Dr. Peter, the chemist to the survey, is such that it scarcely deserves that denomination. This cap and the several inches of fresh coal at the bottom, are among the chief

characteristics of this bed of coal. The main part of the bed, varying between three and four feet thick consists of a very black and very pure, soft bituminous coal, closely resembling the best Pittsburgh varieties in its external appearance. There is some flinty coal between the laminae and a little pyrites. Analyses of the coal from several localities show that it cokes well, with the coke of moderate density and averaging over 60 per cent. Several barrels of coke produced by very rude methods at the Barnby mines, certainly looked like a good coke; and Mr. McAlaffrie, of Princeton, Ky., one of the owners of the Crab Orchard mines of Webster county, (previously referred to) assured me that the coal from that mine produced a coke regarded by Pittsburgh experts as in every way equal to the best Connellsville.

An average proximate analysis of these Trade-water coals is as follows: Specific gravity 1.315. COMPOSITION, DRIED AT 212° F. Volatile combustible matter.....37.00 Carbon in the coke.....55.60 coke 63 Ashes.....7.40 per cent. 100.00. An average ultimate analysis of same gave the following: COMPOSITION, DRIED AT 212° F. Carbon.....78.50 Hydrogen.....5.34 Sulphur......01 Phosphorus......3.80 Nitrogen.....1.85 Oxygen and loss.....10.00 100.00.

Those conversant with these matters will see at once that these coals compare very favorably with Youghiogheny coal, which is so deservedly esteemed by the blacksmiths, and for gas and coke. They are clearly better than any of the other coals used in western Kentucky. But, as has been stated already, their most important advantage lies in their coking capacity, a feature that at no distant day must make them almost indispensable to the reviving iron and kindred industries of Crittenden and adjacent counties.

IRON ORE DEPOSITS.

Iron ore of several varieties occurs at many points in the county, but only those occurring in the flinty debris of the St. Louis limestone north and west of Dycusburg, and those in the same association in the region between Sheridan P. O., and Hurricane furnace, are likely to be of any permanent value. These, therefore, alone deserve mention here.

These two regions contain iron ores not only of first-class quality but in large quantities as well. The first lot is, of course, of prime importance. These ores are limonites, or brown ore, and, both in their association and quality, are precisely like those of Western Tennessee and the region of Western Kentucky, commonly denominated as "between the rivers." The iron which is produced from these ores maintains an excellent reputation for strength and malleability. The Kentucky ore banks, though very actively worked before the war, have not produced much iron since. In the last few years, however, a desire to resume operations has become manifest. Several new furnaces have been built or are under way, and the revival of interest in the iron deposits is making itself felt throughout Western Kentucky. But, Crittenden county, despite the fact that she had formerly demonstrated that her iron deposits are both good and reliable, seems slow in availing herself of the opportunity of "riding with the tide." Thus, while adjoining counties are pushing their properties into the foreground, little or nothing has been done here.

Crittenden furnace, located near Dycusburg, began running in 1849 and continued in blast till the loss of slave labor during the war, caused the owners to shut down. For similar causes the Hurricane furnace, which was in blast during the latter half of that period, discontinued operations. Complete sets of the ores used at these furnaces were analyzed by Dr. Robert Peter, and published in Vol. 1 of the old series of geological reports of the State (1861). I have taken the trouble to work out the average composition of the ores as brought out in these analyses, and, although one of the samples was unusually poor and contained a much larger per cent. of phosphorus than usual, the result is so favorable that it may without fear be submitted for comparison with average analyses of the principal ores of Tennessee and Alabama. It should be mentioned, perhaps, that without the poor sample mentioned, the average phosphorus is 0.11 per cent.

Analyses (partial) of Tennessee, Alabama and Crittenden. Average (partial) of the iron ores. Counted on him, and more statement will suffice.

Location	Kind of Ore	Grain	Grain	Grain	Grain	Grain	Grain	Grain	Grain
Between the rivers	Limonite	1.315	37.00	55.60	7.40	78.50	5.34	.01	3.80
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Comparing the above analyses we find that in the matter of metallic iron the Crittenden ores almost head the list, while the phosphorus, as explained above should really be no more than 0.2 per cent. is considerably lower than in the Clinton ores of both Alabama and Tennessee.

As usual these limonite ores occur exclusively in "pockets," there are numerous but very greatly in extent, a few appearing practically inexhaustible, while many may contain over a thousand tons of ore. In the Hurricane district the deposits are mostly of the smaller sort, but being very abundant the aggregate supply is very large and, no doubt, sufficient to satisfy the demands of a furnace for many years. In the Dycusburg district some of the deposits are unquestionably very large. The majority are situated from one to two miles north of Dycusburg, on each side of Faldy's creek. A large hill on the South side of the creek near the river (owned by Dr. W. S. Graves, and Messrs. Heywood and Marshall) must contain an immense quantity of "honey comb" and "pot" ore—namely the latter. Going up the creek I examined the ore banks chiefly dependent on by the old furnace company. These are not exhausted by any means; great quantities of good ores, principally of the "honey comb" variety, being still in sight. Another body of fine ore occurs on Dr. Graves' land one and one-half miles east of the burg. I have information besides of other bodies in this vicinity which I did not find time to visit. Enough was seen however to convince me that this district could insure a steady supply of ore to large furnaces for a long time.

LEAD, ZINC AND SPAR. It may be stated without fear of contradiction that Crittenden county contains more deposits of lead, zinc, fluor spar and barite than any other section of the State. Most of these have been known for years and only a few are to be regarded as recent discoveries.

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In order to show my appreciation to the purchaser of \$5.00 have developed in Crittenden county. A point on one of these, where shaft nearly fifty feet deep has been sunk, is locally well known as "Flinty silver mine." Much of the interest attached to this discovery, but beyond the mere determination of the existence of iron rocks in this field, they have economic value. In my report the survey I discussed, at length the questions relating to the source of the lead and other minerals in these veins, the horizons at which the greatest deposits may be expected and the depth to which they extend. It is neither necessary nor desirable to go into details here. more statement will suffice.

Geologists are agreed that the minerals in question are chiefly through the "K" segregation from veins with them issuing into the stone walls of the fissures. As usual these limonite ores occur exclusively in "pockets," there are numerous but very greatly in extent, a few appearing practically inexhaustible, while many may contain over a thousand tons of ore. In the Hurricane district the deposits are mostly of the smaller sort, but being very abundant the aggregate supply is very large and, no doubt, sufficient to satisfy the demands of a furnace for many years. In the Dycusburg district some of the deposits are unquestionably very large. The majority are situated from one to two miles north of Dycusburg, on each side of Faldy's creek. A large hill on the South side of the creek near the river (owned by Dr. W. S. Graves, and Messrs. Heywood and Marshall) must contain an immense quantity of "honey comb" and "pot" ore—namely the latter. Going up the creek I examined the ore banks chiefly dependent on by the old furnace company. These are not exhausted by any means; great quantities of good ores, principally of the "honey comb" variety, being still in sight. Another body of fine ore occurs on Dr. Graves' land one and one-half miles east of the burg. I have information besides of other bodies in this vicinity which I did not find time to visit. Enough was seen however to convince me that this district could insure a steady supply of ore to large furnaces for a long time.

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